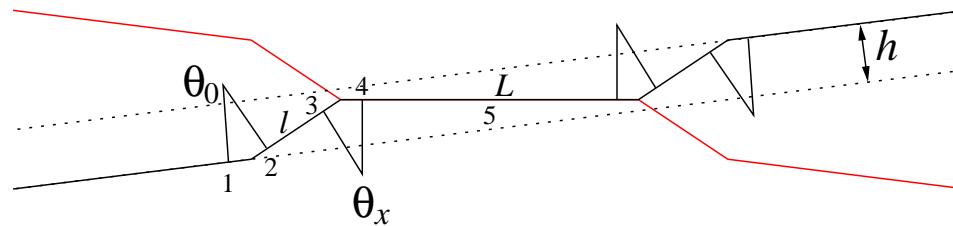


# D0DX and IR alignment studies

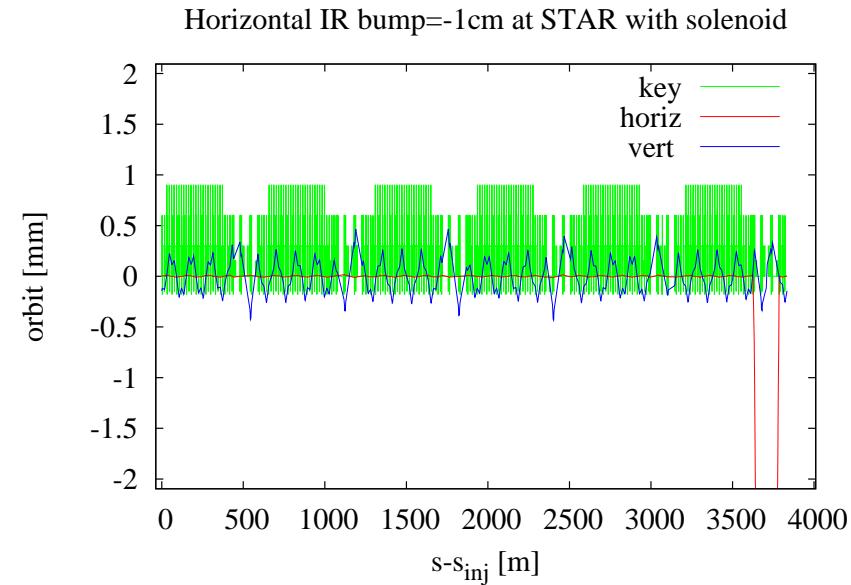
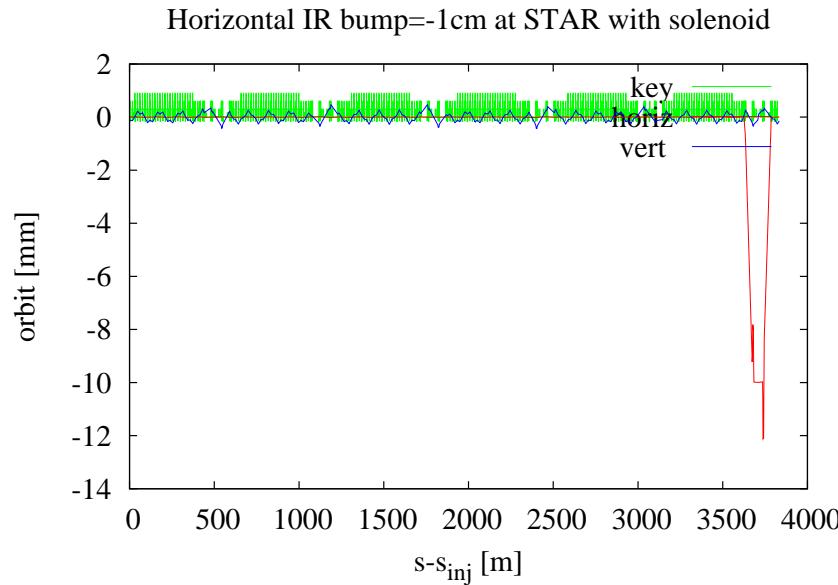
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- Goals:
  - Calibrate DX BPM's. (Use experiment solenoids)
  - Study and Optimize DX and D0 trim settings.
  - Find aperture limits for large crossing angles. (Higher energy)
- Benefits:
  - improve orbit measurements for luminosity scanning.
  - reduce backgrounds.
  - minimize spin tune shifts with rotators.
  - better orbits for pp2pp experiment.
  - low energy Au collisions.
  - investigate aperture for higher energies ( $\gtrsim 20\%$  more) with nonzero crossing angles at separated IR's.

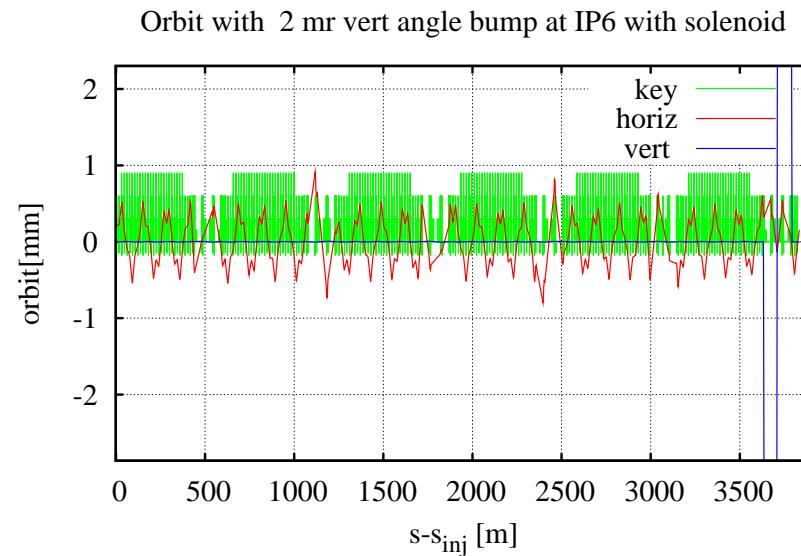
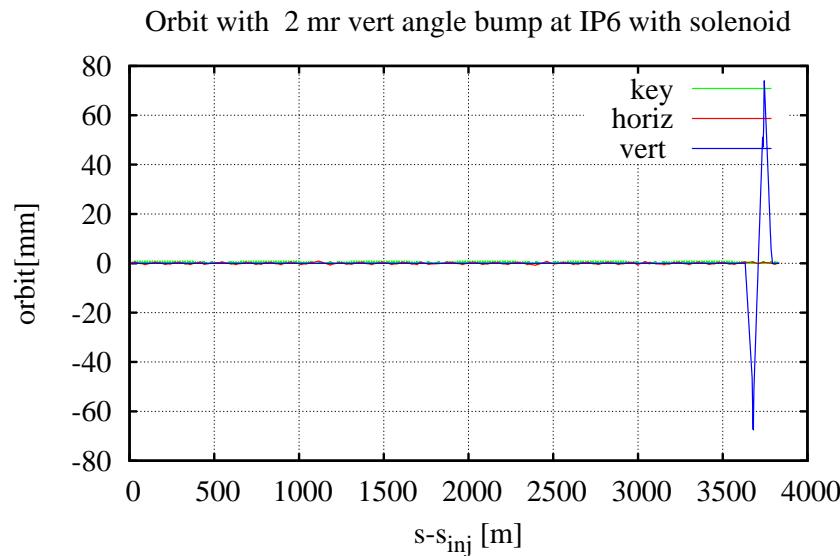
- Description of experiment
  - For the most part it will be performed at injection energy.
    - Orbit differences: STAR (or PHENIX) solenoid on–off
    - Calibrate DX bpm settings.
      - 4 BPMs between Q1's ⇒ straight line in vert plane.
    - Flatten orbit through Q1-Q4 regions on both sides of IR.
    - Adjust DX and D0 trim settings.
- Resources
  - Other people: Todd, Christoph, Dejan, Angelika, Vadim, Michiko, Rob Michnoff, Robert Hulsart, ...
  - Instrumentation: BPM's, tune measurements
  - Applications: Orbit measurement and control, tunes, scripts to automate measurements
  - Time: to be determined
- Plans for data analysis:
  - Perform ORM-type analysis on orbit measurements and compare with models

# Effect of solenoid: position scan

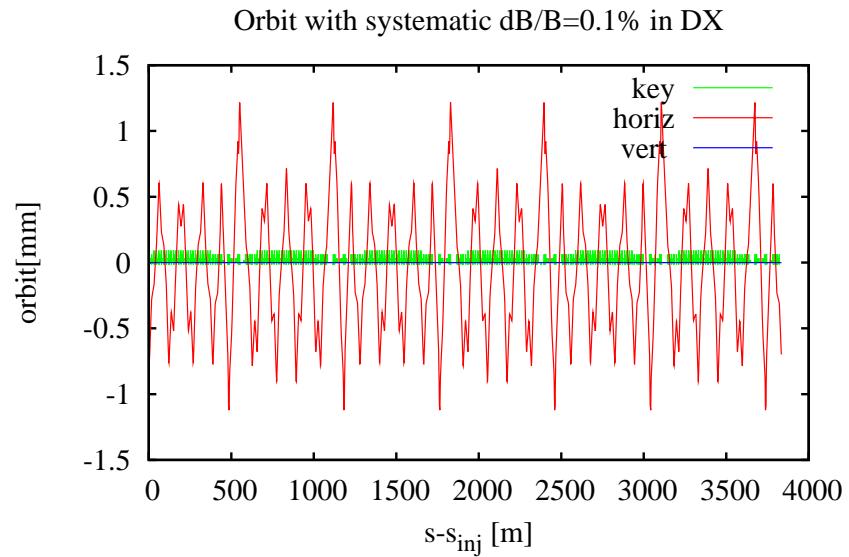
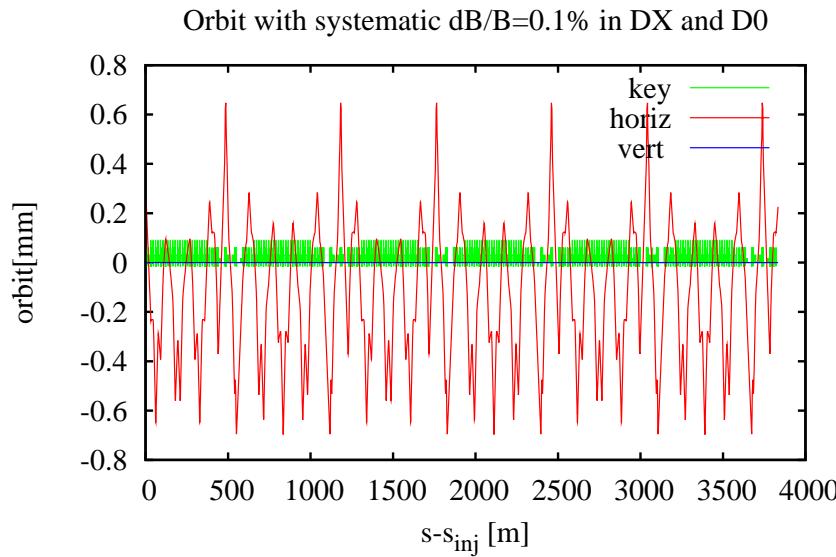


- At injection, correctors are strong enough for an 8.8 cm bump.
  - This would probably hit the aperture in the D0 magnets or triplets, but a few cm should work and give a better measurement.
- Simulations with new version of b1 with spin added.  
See MacKay, “An Interactive Beam Line Simulator Module for RHIC”, PAC97, 2541 (1997).

# Effect of solenoid: angle scan

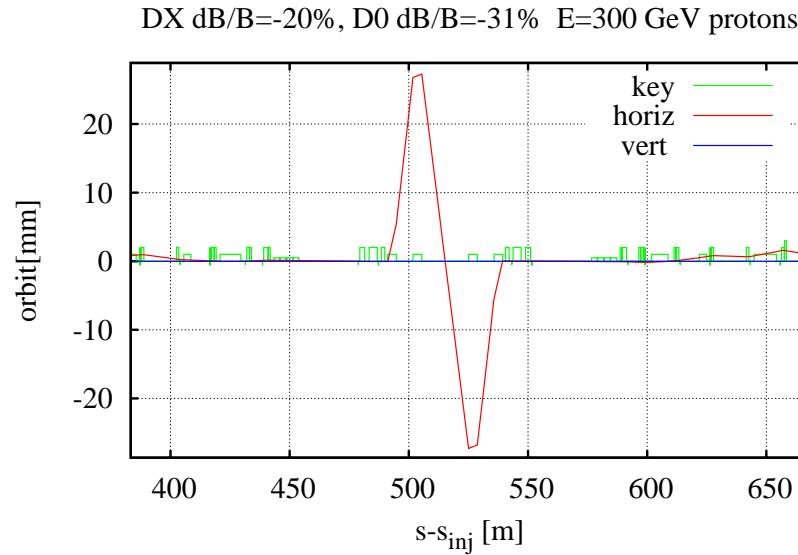
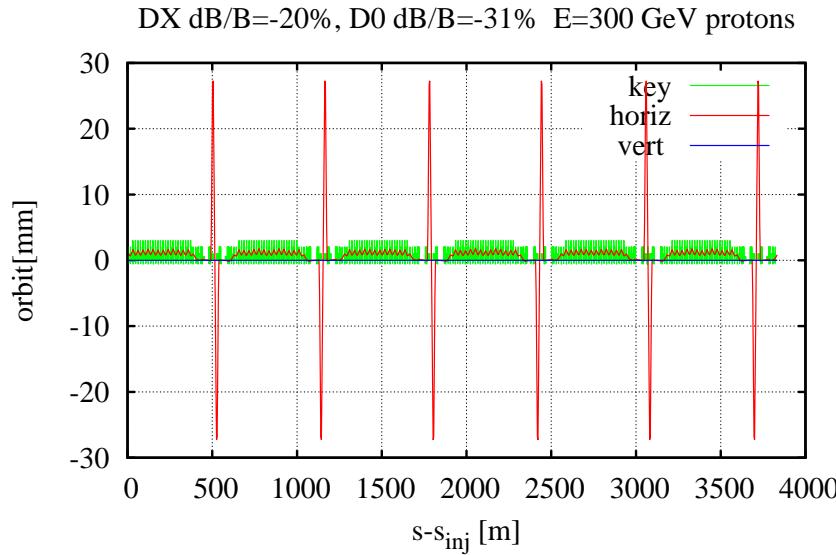


# All D0 and DX dB/B=0.1%



- All IR's with  $\beta^* = 10$  m.
- Path length changes in IR's and fixed  $f_{\text{rf}}$  shift energy slightly.

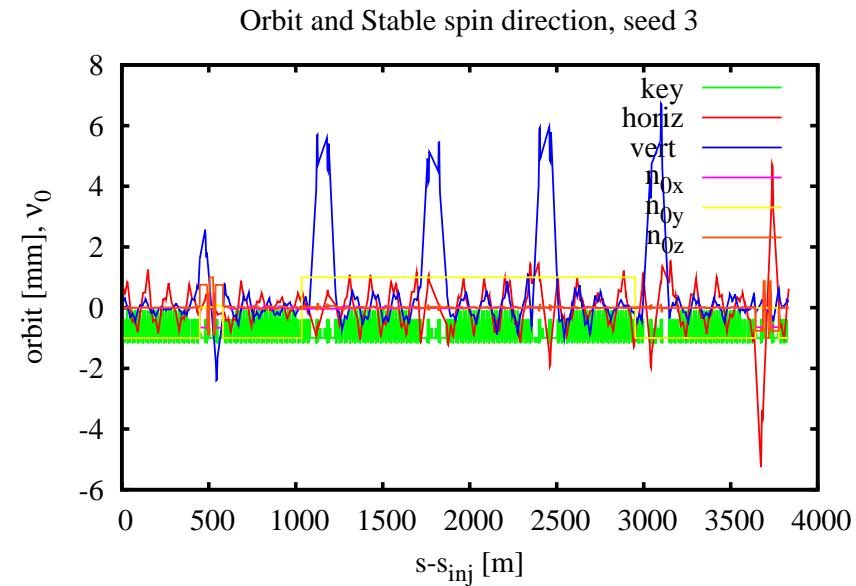
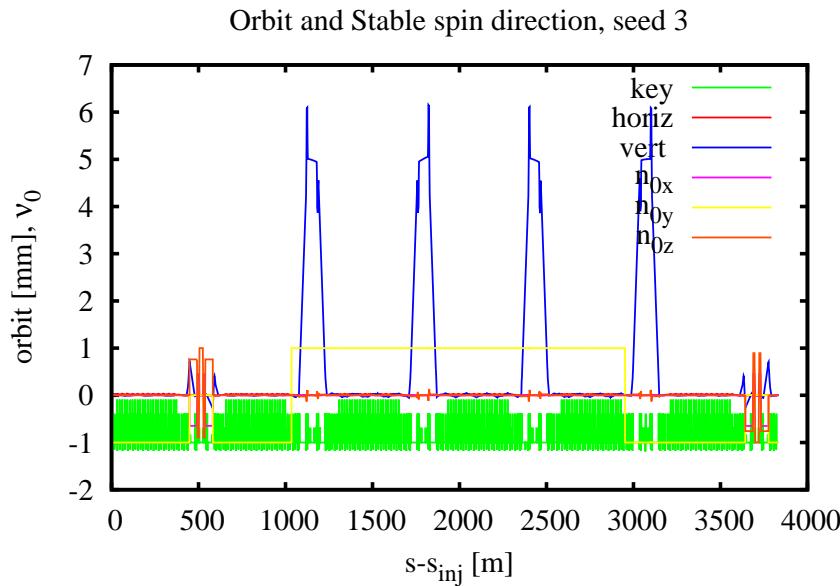
# 300 GeV protons with 5.6 mr Xing angle



- 20% Higher energy: 20% higher field in arc dipoles
  - Arc dipole short sample 30% higher fields.
- DX magnets at 250 GeV field level
- D0 magnets at  $+20\% - 31\% = -11\%$  lower field than at 250 GeV
- $2 \times 2.78 = 5.6$  mr crossing angle

See “Feasibility of Increasing the Beam Energy of RHIC”, PAC01, 3129 (2001).

# IR Spin tune effects



# IR Spin tune effects

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IP8rot	IP6rot	IP6sol	seed	$w_{\text{cut}}$	$\nu_0$	$\sigma_x$ arc	$\sigma_y$ arc
Vert	Vert	off	none	0.000	0.500005	0.001	0.013
Vert	Vert	on	none	0.000	0.500011	0.001	0.013
Long	Long	off	none	0.000	0.499505	0.008	0.018
Long	Long	on	none	0.000	0.496706	0.008	0.018
Vert	Vert	on	3	0.100	0.496966	0.502	0.307
Long	Long	on	3	0.100	0.490214	0.502	0.304
Long	Long	on	3	-0.100	0.503130	0.502	0.332

- Arc  $\sigma$ 's in mm
- flat random misalignments of arc quads (Q7→Q7) between  $\pm w_{\text{cut}}$  mm.
  - Note: negative  $w_{\text{cut}}$  reversed sign of misalignments.